| FORM PTO-1390 (REV. 5-93) | U.S. DEPARTMENT OF COMMERCE PATENT AND TRADEMARK OFFICE | ATTORNEY'S DOCKET NUMBER **10191/2008** |
|---|---|---|

**TRANSMITTAL LETTER TO THE UNITED STATES DESIGNATED/ELECTED OFFICE (DO/EO/US) CONCERNING A FILING UNDER 35 U.S.C. 371**

U.S. APPLICATION NO. (If known, see 37 CFR 1.5)
09/936115

| INTERNATIONAL APPLICATION NO. | INTERNATIONAL FILING DATE | PRIORITY DATE CLAIMED: |
|---|---|---|
| **PCT/DE00/00430** | **(15.02.00) 15 February 2000** | **(06.03.99) 06 March 1999** |

TITLE OF INVENTION
**DATA TRANSMISSION DEVICE AND METHOD**

APPLICANT(S) FOR DO/EO/US
**KOWALEWSKI, Frank**

Applicant herewith submits to the United States Designated/Elected Office (DO/EO/US) the following items and other information

1. ☒ This is a **FIRST** submission of items concerning a filing under 35 U.S.C. 371.
2. ☐ This is a **SECOND** or **SUBSEQUENT** submission of items concerning a filing under 35 U.S.C. 371.
3. ☒ This express request to begin national examination procedures (35 U.S.C. 371(f)) immediately rather than delay examination until the expiration of the applicable time limit set in 35 U.S.C. 371(b) and PCT Articles 22 and 39(1).
4. ☒ A proper Demand for International Preliminary Examination was made by the 19th month from the earliest claimed priority date.
5. ☒ A copy of the International Application as filed (35 U.S.C. 371(c)(2))
   a. ☐ is transmitted herewith (required only if not transmitted by the International Bureau).
   b. ☒ has been transmitted by the International Bureau.
   c. ☐ is not required, as the application was filed in the United States Receiving Office (RO/US)
6. ☐ A translation of the International Application into English (35 U.S.C. 371(c)(2)).
7. ☒ Amendments to the claims of the International Application under PCT Article 19 (35 U.S.C. 371(c)(3))
   a. ☐ are transmitted herewith (required only if not transmitted by the International Bureau).
   b. ☐ have been transmitted by the International Bureau.
   c. ☐ have not been made; however, the time limit for making such amendments has NOT expired.
   d. ☒ have not been made and will not be made.
8. ☐ A translation of the amendments to the claims under PCT Article 19 (35 U.S.C. 371(c)(3)).
9. ☐ An oath or declaration of the inventor(s) (35 U.S.C. 371(c)(4)) (unsigned).
10. ☐ A translation of the annexes to the International Preliminary Examination Report under PCT Article 36 (35 U.S.C. 371(c)(5)).

**Items 11. to 16. below concern other document(s) or information included:**

11. ☒ An Information Disclosure Statement under 37 CFR 1.97 and 1.98.
12. ☐ An assignment document for recording. A separate cover sheet in compliance with 37 CFR 3.28 and 3.31 is included.
13. ☐ A **FIRST** preliminary amendment.
    ☐ A **SECOND** or **SUBSEQUENT** preliminary amendment.
14. ☐ A substitute specification.
15. ☐ A change of power of attorney and/or address letter.
16. ☒ Other items or information: Search Report, PCT/RO/101.

**EXPRESS MAIL NO.: EL243101470US**

| U.S. APPLICATION NO. (if known, see 37 C.F.R.1.5) 09/936115 | INTERNATIONAL APPLICATION NO. PCT/DE00/00430 | ATTORNEY'S DOCKET NUMBER 10191/2008 |
|---|---|---|

| 17. ☒ The following fees are submitted: | CALCULATIONS | PTO USE ONLY |
|---|---|---|
| **Basic National Fee (37 CFR 1.492(a)(1)-(5)):** Search Report has been prepared by the EPO or JPO . . . . . $860.00 | | |
| International preliminary examination fee paid to USPTO (37 CFR 1.482) . . . $690.00 | | |
| No international preliminary examination fee paid to USPTO (37 CFR 1.482) but international search fee paid to USPTO (37 CFR 1.445(a)(2)) . . . . . $710.00 | | |
| Neither international preliminary examination fee (37 CFR 1.482) nor international search fee (37 CFR 1.445(a)(2)) paid to USPTO . . . . . $1000.00 | | |
| International preliminary examination fee paid to USPTO (37 CFR 1.482) and all claims satisfied provisions of PCT Article 33(2)-(4) . . . . . $100.00 | | |
| **ENTER APPROPRIATE BASIC FEE AMOUNT =** | $ 860.00 | |
| Surcharge of $130.00 for furnishing the oath or declaration later than ☐ 20 ☐ 30 months from the earliest claimed priority date (37 CFR 1.492(e)). | $ | |

| Claims | Number Filed | Number Extra | Rate | | |
|---|---|---|---|---|---|
| Total Claims | 11 - 20 = | 0 | X $18.00 | $ 0.00 | |
| Independent Claims | 1 - 3 = | 0 | X $80.00 | $ 0.00 | |
| Multiple dependent claim(s) (if applicable) | | | + $270.00 | $ | |
| **TOTAL OF ABOVE CALCULATIONS =** | | | | $ 860.00 | |
| Reduction by ½ for filing by small entity, if applicable. Verified Small Entity statement must also be filed. (Note 37 CFR 1.9, 1.27, 1.28). | | | | $ | |
| **SUBTOTAL =** | | | | $ 860.00 | |
| Processing fee of $130.00 for furnishing the English translation later the ☐ 20 ☐ 30 months from the earliest claimed priority date (37 CFR 1.492(f)). + | | | | $ | |
| **TOTAL NATIONAL FEE =** | | | | $ 860.00 | |
| Fee for recording the enclosed assignment (37 CFR 1.21(h)). The assignment must be accompanied by an appropriate cover sheet (37 CFR 3.28, 3.31). $40.00 per property + | | | | $ | |
| **TOTAL FEES ENCLOSED =** | | | | $ 860.00 | |
| | | | | Amount to be: refunded | $ |
| | | | | charged | $ |

a. ☐ A check in the amount of $_____ to cover the above fees is enclosed.

b. ☒ Please charge my Deposit Account No. 11-0600 in the amount of **$860.00** to cover the above fees. A duplicate copy of this sheet is enclosed.

c. ☒ The Commissioner is hereby authorized to charge any additional fees which may be required, or credit any overpayment to Deposit Account No. 11-0600. A duplicate copy of this sheet is enclosed.

**NOTE:** Where an appropriate time limit under 37 CFR 1.494 or 1.495 has not been met, a petition to revive (37 CFR 1.137(a) or (b)) must be filed and granted to restore the application to pending status.

SEND ALL CORRESPONDENCE TO:

Kenyon & Kenyon
One Broadway
New York, New York 10004

SIGNATURE

Richard L. Mayer, Reg. No. 22,490
NAME

9/6/01
DATE

#4

PTO/PCT MAIL 02 JAN 2002 10191/2008]

**IN THE UNITED STATES PATENT AND TRADEMARK OFFICE**

| | | |
|---|---|---|
| Inventor(s) | : | Frank KOWALEWSKI |
| Serial No. | : | 09/936,115 |
| Filed | : | September 6, 2001 |
| For | : | DATA TRANSMISSION DEVICE AND METHOD |
| Examiner | : | To Be Assigned |
| Art Unit | : | To Be Assigned |

Assistant Commissioner
for Patents
Washington, D.C. 20231

**PRELIMINARY AMENDMENT**

SIR:

Kindly amend the above-identified application before examination, as set forth below.

**IN THE TITLE:**

Please replace the title with the following: --DATA TRANSMISSION DEVICE AND METHOD--.

**IN THE DRAWINGS:**

Please amend the drawings as indicated on the attached red-marked sheets.

**IN THE SPECIFICATION:**

Please amend the specification, including abstract, pursuant to the attached substitute specification. Also attached is a marked up copy of the specification, indicating deleted and added sections. No new matter has been added.

**IN THE CLAIMS:**

Please cancel claims 1-11 in the underlying PCT application, without prejudice.

Please add the following new claims:

12. (New) A data transmission device for use with multiple data transmission technologies and/or multiple data transmission parameters of one or more data transmission technologies, comprising:

a transmitting device and a receiving device configured to communicate with one another over at least one data transmission channel;

a determination device configured to determine transmission properties of the at least one data transmission channel, the properties being at least one of: i) properties of multiple data transmission technologies, and ii) multiple data transmission parameters of at least one data transmission technology; and

a selector device coupled to the determination device and to at least one of the transmitting device and the receiving device, the selector device being configured to select a certain data transmission technology having certain data transmission parameters according to a result of the determination.

13. (New) The data transmission device according to claim 12, wherein the selector device is coupled to the transmitting device.

14. (New) The data transmission device according to claim 12, wherein the selector device is coupled to the receiving device.

15. (New) The data transmission device according to claim 12, wherein the data transmission channel is a wireless channel.

16. (New) The data transmission device according to claim 12, wherein the determination device is configured to determine a rate of change of the data transmission channel.

17. (New) The data transmission device according to claim 16, wherein the selector device is configured to make the selection so that interferences in the receiving device are eliminated when the rate of change of the data transmission channel exceeds a predetermined value, and interferences in the transmitting device are eliminated when the rate of change of the data transmission channel drops below a predetermined level.

18. (New) The data transmission device according to claim 12, wherein the determination device is configured to determine a maximum delay of the data transmission channel.

19. (New) The data transmission device according to claim 18, wherein the selector device is configured to make the selection so that a transmission technology having a certain burst structure is selected as a function of the maximum delay determined for the data transmission channel.

20. (New) The data transmission device according to claim 12, wherein the selector device is configured to make the selection so that a transmission technology having a certain reference signal is selected as a function of at least one of: i) a maximum delay for the data transmission channel, and ii) a rate of change of the data transmission channel.

21. (New) The data transmission device according claim 12, wherein the data transmission device is a mobile wireless device.

22. (New) The data transmission device according to claim 21, wherein the data transmission device is a mobile telephone.

23. (New) A data transmission method for use with multiple data transmission technologies and/or multiple data transmission parameters of one or more data transmission technologies for implementation on at least one transmitting device and one receiving device which can communicate with one another over at least one data transmission channel, the method comprising:

determining transmission properties of the at least one data transmission channel, the properties being at least one of: i) properties of multiple data transmission technologies, and ii) multiple data transmission parameters of at least one data transmission technologies; and

selecting a certain data transmission technology having certain data transmission parameters according to the determination.

**REMARKS**

This Preliminary Amendment cancels, without prejudice, claims 1-11 and adds new claims 12-23. The new claims conform the claims to the U.S. Patent and Trademark Office rules and does not add new matter to the application.

The amendments to the specification and abstract reflected in the substitute specification are to conform the specification and abstract to U.S. Patent and Trademark Office rules, and do not introduce new matter into the application.

The underlying PCT Application No. PCT/DE00/00430 also includes an International Preliminary Examination Report, issued April 24, 2001. A translation of the International Preliminary Examination Report is included herewith.

It is respectfully submitted that the present invention is new, non-obvious, and useful. Prompt consideration and allowance of the claims are respectfully requested.

Respectfully Submitted,

KENYON & KENYON

Dated: 2 Jan 2002

By: _____ (Reg. No. 36098)

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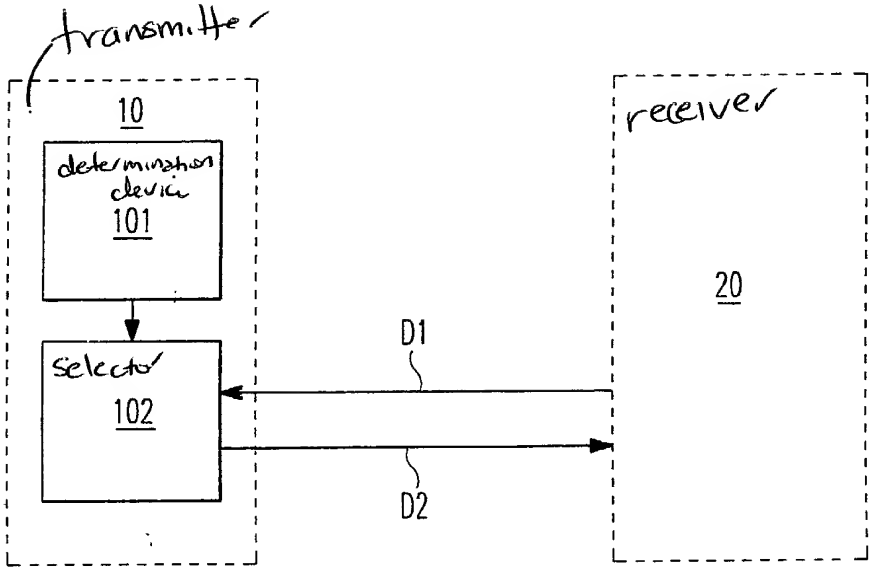
transmitter
10
determination device
101
selector
102
receiver
20
D1
D2

Fig. 1

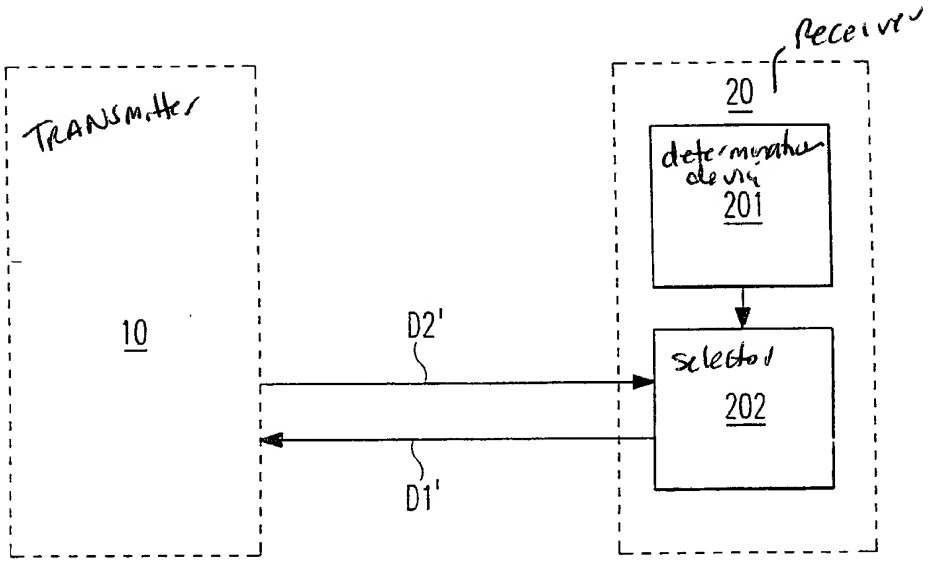
Receiver
TRANSMITTER
10
20
determination device
201
selector
202
D2'
D1'

Fig. 2

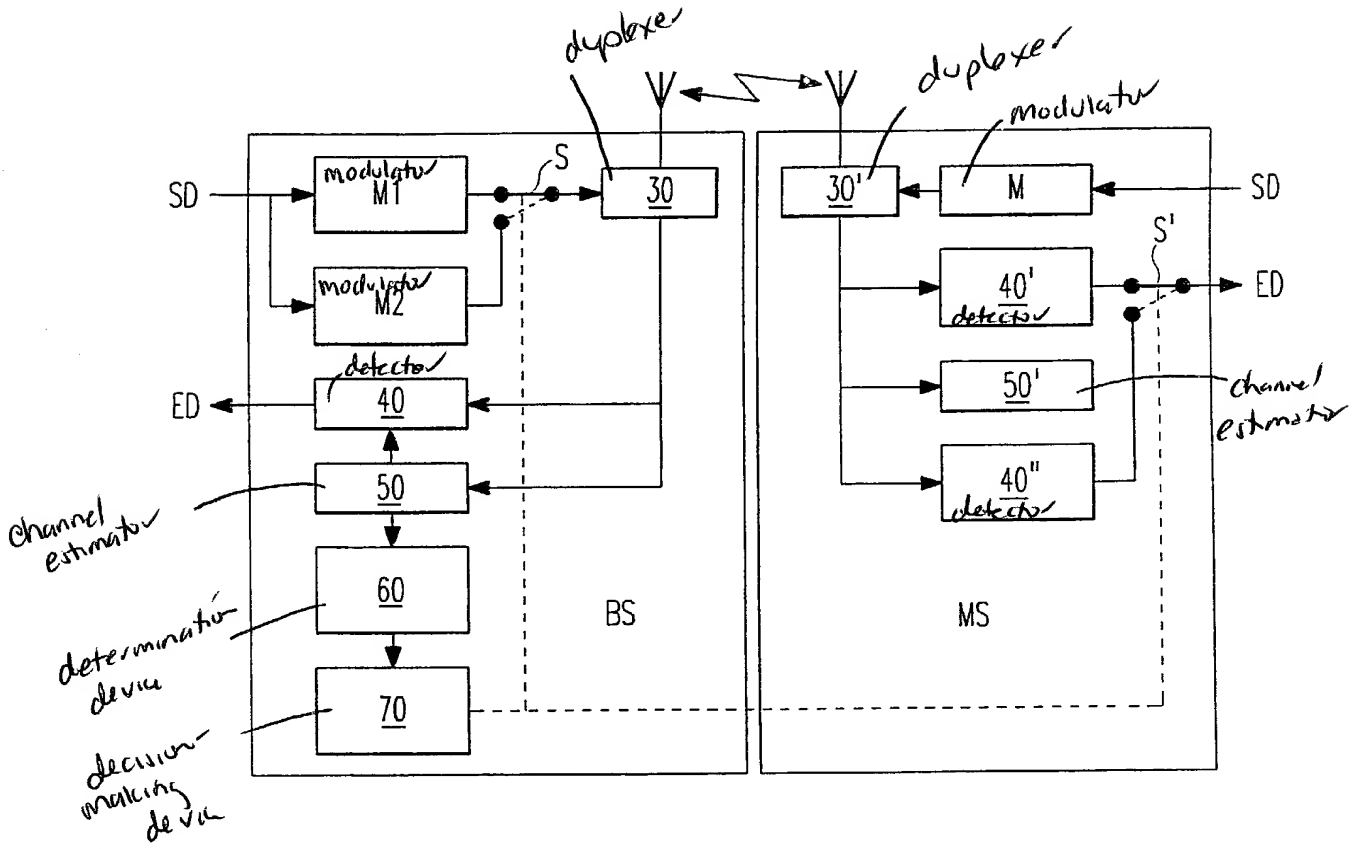
duplexer
duplexer
modulator
SD
modulator M1
S
30
30'
M
SD
S'
modulator M2
40'
detector
ED
ED
detector
40
50'
channel estimator
50
40"
detector
channel estimator
60
BS
MS
determination device
70
decision-making device

Fig. 3

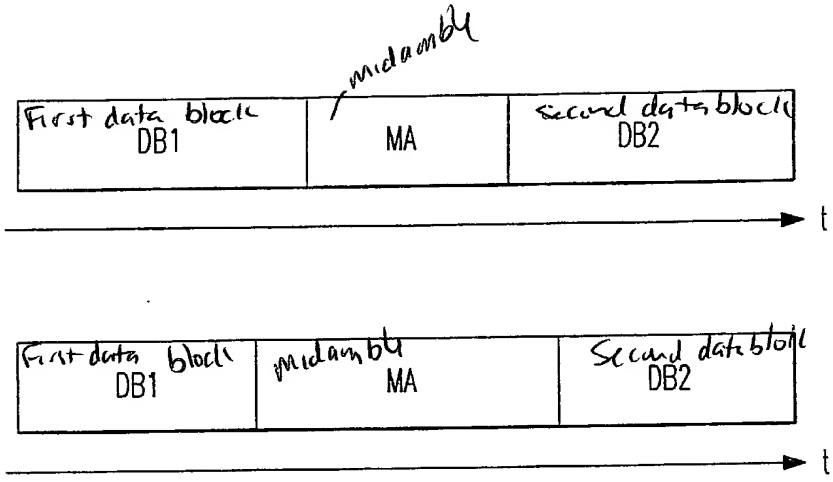
midamble
First data block
DB1
MA
Second data block
DB2
t
First data block
DB1
midamble
MA
Second data block
DB2
t

Fig. 4

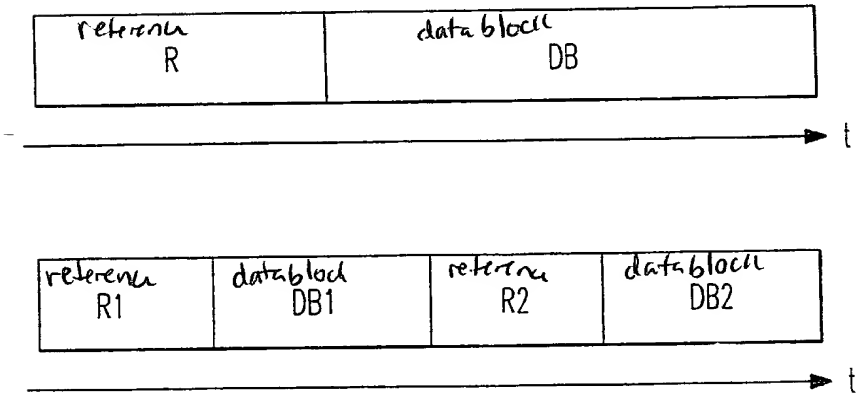
reference
R
data block
DB
t
reference
R1
data block
DB1
reference
R2
data block
DB2
t

Fig. 5

# DATA TRANSMISSION DEVICE AND METHOD

## FIELD OF THE INVENTION

The present invention relates to a data transmission device which may use multiple data transmission technologies and/or multiple data transmission parameters of one or more data transmission technologies, having at least one transmitting device and one receiving device which can communicate with one another over at least one data transmission channel. The present invention also relates to a corresponding data transmission method.

## BACKGROUND INFORMATION

Although the present invention can be used with all desired data transmission technologies, it is explained here together with the problems on which it is based from the standpoint of mobile wireless technology.

There are various conventional technologies for multichannel wireless transmission, in particular TDMA (time division multiple access), e.g., GSM (global system for mobile telecommunications) or UMTS (universal mobile telecommunication system), FDMA (frequency division multiple access), e.g., DECT (digital enhanced telecommunication), GSM (global system for mobile telecommunications), DAB (digital audio broadcasting) and CDMA (code division multiple access) (IS95, UMTS).

Problematic interference which can occur with these different technologies is usually handled in different ways, if at all. In particular, conventional methods include elimination of intersymbol interference (ISI), elimination of multiple access interference (MAI), elimination of interference in the

receiver, e.g., by equalizers or multiuser methods or joint detection methods, as well as elimination in the sender by pre-rake or joint preliminary equalization. See, for example, K. D. Kammeyer, "Nachrichtenübertragung [Transmission of Communications]," 2nd edition, *Information Technology Series*, Teubner, Stuttgart, 1996, and A. Klein, G. K. Kaleh and P. W. Baier, "Zero Forcing and Minimum Mean-Square-Error Equalization for Multiuser Detection in Code-Division Multiple-Access Channels," *IEEE Trans. Vehic. Tech.*, vol. 45 (1996), 276-287 and R. Esmailzadeh and M. Nakagawa, "Pre-Rake Diversity Combination for Direct Sequence Spread Spectrum Mobile Communications Systems," *IEICE Trans. Comm.*, vol. E76-B (1993), 1008-1015.

In addition, different parameters are generally used under different transmission conditions, e.g., in the UMTS TDD mode, where different types of bursts are used, depending on the maximum channel delay. In this regard, see, the example, the UMTS-L1 expert group: "UTRA Physical Layer Description, TDD parts, V 0.2.0."

One disadvantage of the conventional approaches is that a transmission technology having a given set of parameters is more advantageous than another transmission technology only under certain transmission conditions or with certain transmission properties of the data transmission channel.

Therefore, it may occur that an unnecessarily low transmission quality prevails under certain transmission conditions or there may be an unnecessarily great dependence of transmission quality on transmission conditions.

It would thus be desirable to create a data transmission system which can always guarantee optimum transmission quality, regardless of whether data transmission conditions

are variable or constant.

SUMMARY

In accordance with an example embodiment of the present invention, a data transmission device is provided in which it is possible to accommodate different transmission properties.

In other words, it is possible to improve the data transmission under variable transmission conditions or to have data transmission quality be largely independent of transmission conditions. Assuming uniform transmission conditions, the resulting transmission quality will be either the same or better.

In accordance with the example embodiment, a determination device may be provided for determining the transmission properties of the data transmission channel(s) for multiple data transmission technologies and/or multiple data transmission parameters of one or more data transmission technologies and to provide a selector device for selecting a certain data transmission technology having certain data transmission parameters according to the result of the determination.

According to one example embodiment, a selector device may be provided in the transmitting device.

According to another example embodiment, the selector device may be provided in the receiving device.

According to another example embodiment, the data transmission channel is a wireless channel.

According to another example embodiment, the determination device is designed to determine the rate of change of the data

transmission channel.

According to another example embodiment, the selector device makes the selection in such a way that interference in the receiving device is eliminated when the rate of change of the data transmission channel exceeds a predetermined value, and interference in the transmitting device is eliminated when the rate of change of the data transmission channel drops below a predetermined value.

According to another example embodiment, the determination device is designed to determine the maximum delay of the data transmission channel.

According to another example embodiment, the selector device makes the selection in such a way that it selects a transmission technology having a certain burst structure as a function of the maximum delay determined for the data transmission channel.

According to another example embodiment, the selector device makes the selection in such a way that it selects a transmission technology having a certain reference signal as a function of the maximum delay determined for the data transmission channel and/or the rate of change determined.

According to another example embodiment, the data transmission device is a mobile wireless device, for example, a mobile telephone.

BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 shows a schematic diagram of a data transmission device according to a first example embodiment of the present invention.

Figure 2 shows a schematic diagram of a data transmission device according to a second example embodiment of the present invention.

Figure 3 shows a schematic diagram of a data transmission device according to a third example embodiment of the present invention.

Figure 4 shows burst structures for estimating short and long channels.

Figure 5 shows burst structures for estimating slowly and rapidly variable channels.

DETAILED DESCRIPTION

In the figures, the same reference numbers denote the same components or those having the same function.

Figure 1 shows a schematic diagram of a data transmission device according to a first embodiment of the present invention.

Figure 1 shows a transmitter 10, a receiver 20, a determination device 101 for determining the transmission properties of the transmission channel, a selector device 102 for selecting a certain data transmission technology having certain data transmission parameters as well as data messages D1 and D2.

As shown in the diagram of Figure 1, transmitter 10 first sends an inquiry to receiver 20, requesting it to respond with various transmission technologies and parameters. Receiver 20 then sends data message D1 to transmitter 10, indicating which technologies and respective parameters are supported.

Determination device 101 then determines the transmission properties of the data transmission channel(s), and selector device 102 selects a certain data transmission technology having certain data transmission parameters according to the result of the determination.

Transmitter 10 notifies receiver 20 of the technology selected and the respective parameters in data message D2.

Figure 2 shows a schematic diagram of a data transmission device as a second example embodiment of the present invention.

In addition to the determination device already introduced, Figure 2 also shows a determination device 201 for determining the transmission properties of the data transmission channel, a selector device 202 for selecting a certain data transmission technology having certain data transmission parameters as well as data messages D1' and D2'.

As shown in the diagram in Figure 2, receiver 20 first sends an inquiry to transmitter 10, requesting it to respond with various transmission technologies and parameters. Transmitter 10 then sends data message D2' to receiver 20, indicating which technologies and respective parameters are supported.

Determination device 201 then determines the transmission properties of the data transmission channel(s), and selector device 202 selects a certain data transmission technology having certain data transmission parameters according to the result of the determination.

Receiver 20 notifies transmitter 10 of the technology selected and the respective parameters in data message D1'.

Figure 3 shows a schematic diagram of a data transmission device according to a third example embodiment of the present invention.

The data transmission device shown in Figure 3 is a cellular wireless transmission system in which there is a transmission from a base station BS to multiple mobile stations MS in the forward link and transmission from multiple mobile stations MS to base station BS in the reverse link. Data streams of various users (mobile stations MS) are separated by code division multiple access (CDMA), for example.

In the TDD wireless transmission system shown here, the forward and reverse links are in the same frequency band. The forward and reverse links are separated in time by alternating transmission of transmission bursts in the forward and reverse links.

Interference in the forward link is eliminated optionally either in the transmitter or in the receiver, e.g., by eliminating interference in the transmitter through joint preliminary equalization or by eliminating interference in the receiver through joint detection as described in the article by Klein et al. (discused above).

An example of selecting the technology for eliminating interference in the forward link would be to determine the rate of change of the wireless channel by comparing successive channel estimates in the base station and to eliminate interference through joint preliminary equalization in the transmitter if the rate of change is below a certain threshold, and to eliminate interference through joint detection in the receiver if the rate of change is above the threshold.

Figure 3 shows transmitted data SD, received data ED, duplexers 30 and 30', a modulator M1 without preliminary equalization, a modulator M2 having preliminary equalization, a modulator M, detectors 40, 40' and 40", a channel estimator 50 and 50', a determination device 60 and a decision-making device or selector device 70. Switches S and S' can be switched by decision-making device 70.

Base station BS has a transmission part having modulators M2 and M1 with and without preliminary equalization, respectively, and a reception part having detector 40 and channel estimator 50 as well as a decision-making part for making a decision between preliminary equalization and joint detection, composed of determination device 60 and decision-making device 70. Selector switch S is used to select modulator M1 or M2. Selector switch S is controlled by decision-making device 70.

Mobile station MS has a transmission part having modulator M and a reception part having channel estimator 50', as well as detector 40' for joint detection and detector 40" for simple detection.

Decision-making device 70 in base station BS selects either no preliminary equalization in base station BS and joint detection in mobile station MS, or preliminary equalization in base station BS and simple detection in mobile station MS, depending on the result obtained by channel estimator 50 and determination device 60. The decision made by decision-making device 70 of base station BS is relayed to mobile station MS over the wireless interface.

Figure 4 shows burst structures for estimating short and long channels.

Another example of a cellular wireless transmission system as an embodiment of the data transmission device according to the present invention has block-wise data transmission in a data burst structure as illustrated in Figure 4, where DB1 denotes a first data block, DB2 is a second data block, and MA is a midamble connected between them, with time t running from left to right.

The reverse link is optionally one of two possible burst structures, namely a burst structure having long data blocks and a short midamble, and a burst structure having short data blocks and a long midamble. The choice of data burst structure is made on the basis of a determination of the maximum channel delay by the mobile station in the forward link.

The choice of burst structure for the reverse link is made according to the maximum delay determined, namely a long midamble MA with long delays and a short midamble with short delays.

The type of burst that has been transmitted is determined in the receiver on the basis of the signal received. This embodiment can be used in particular in UMTS TDD mode.

Figure 5 shows burst structures for estimating slowly and rapidly variable channels.

In this embodiment in the form of a cellular wireless transmission system, there is block-wise data transmission in a data burst structure. Reference signal R or R1 or R2 and data block DB or DB1 or DB2 are sent in chronological order. One of two possible burst structures is optionally used, namely a long reference signal R and a long data block DB or multiple short reference signals R1, R2 which are separated from one another by reduced data blocks DB1, DB2.

The burst structure is selected by determining the rate of change in the wireless channel with the help of the reference signal by a comparison of successive channel estimates in base station BS or in mobile station MS.

The burst having a long reference signal R is selected if the rate of change of the channel is below a certain threshold, and the burst having multiple short reference signals R1, R2 is selected if the rate of change is above the threshold.

The type of burst that has been transmitted is determined in the receiver on the basis of the received signal. This embodiment can also be used for the UMTS standard.

Although the present invention is described above on the basis of example embodiments, it is not limited to these embodiments, but instead can be modified in various ways.

Another example embodiment includes a wireless transmission system which supports various standards such as transmission according to the GSM standard and transmission according to the USTM standard.

A determination of the rate of change of the wireless channel and the maximum channel delay could be provided here. The choice of the transmission technology and the respective transmission parameters could be made by optimizing the data transmission quality at the measured rate of change and the measured delays.

Contrary to the description of the above example embodiments, the transmitter or receiver can also notify its remote station, without being explicitly required to do so, regarding which transmission technologies and parameters it supports, e.g., directly after establishing the connection.

ABSTRACT

A data transmission device is described which may use multiple data transmission technologies and/or multiple data transmission parameters of one or more data transmission technologies, having at least one transmitting device and one receiving device which can communicate with one another over at least one data transmission channel. A determination device for determining the transmission properties of the data transmission channel(s) for multiple data transmission technologies and/or multiple data transmission parameters of one or more data transmission technologies, and a selector device for selecting a certain data transmission technology having certain data transmission parameters according to the result of the determination, are additionally provided so as to be able to accommodate different transmission properties.

# DATA TRANSMISSION DEVICE AND METHOD

[Background Information] FIELD OF THE INVENTION

The present invention relates to a data transmission device which may use multiple data transmission technologies and/or multiple data transmission parameters of one or more data transmission technologies, having at least one transmitting device and one receiving device which can communicate with one another over at least one data transmission channel[, as well as]. The present invention also relates to a corresponding data transmission method.

BACKGROUND INFORMATION

Although the present invention can be used with all desired data transmission technologies, it is explained here together with the problems on which it is based from the standpoint of mobile wireless technology.

There are various conventional technologies [in the related art] for multichannel wireless transmission, in particular TDMA (time division multiple access), e.g., GSM (global system for mobile telecommunications) or UMTS (universal mobile telecommunication system), FDMA (frequency division multiple access), e.g., DECT (digital enhanced telecommunication), GSM (global system for mobile telecommunications), DAB (digital audio broadcasting) and CDMA (code division multiple access) (IS95, UMTS).

Problematic interference which can occur with these different technologies is usually handled in different ways, if at all. In particular, [known] conventional methods include elimination of intersymbol interference (ISI), elimination of

multiple access interference (MAI), elimination of interference in the receiver, e.g., by equalizers or multiuser methods or joint detection methods, as well as elimination in the sender by pre-rake or joint preliminary equalization. See, for example, K. D. Kammeyer, "Nachrichtenübertragung [Transmission of Communications]," 2nd edition, *Information Technology Series*, Teubner, Stuttgart, 1996, and A. Klein, G. K. Kaleh and P. W. Baier, "Zero Forcing and Minimum Mean-Square-Error Equalization for Multiuser Detection in Code-Division Multiple-Access Channels," *IEEE Trans. Vehic. Tech.*, vol. 45 (1996), 276-287 and R. Esmailzadeh and M. Nakagawa, "Pre-Rake Diversity Combination for Direct Sequence Spread Spectrum Mobile Communications Systems," *IEICE Trans. Comm.*, vol. E76-B (1993), 1008-1015.

In addition, different parameters are generally used under different transmission conditions, e.g., in the UMTS TDD mode, where different types of bursts are used, depending on the maximum channel delay. In this regard, see, the example, the UMTS-L1 expert group: "UTRA Physical Layer Description, TDD parts, V 0.2.0."

One disadvantage of the [known] conventional approaches [has been found to be the fact] is that a transmission technology having a given set of parameters is more advantageous than another transmission technology only under certain transmission conditions or with certain transmission properties of the data transmission channel.

Therefore, it may occur that an unnecessarily low transmission quality prevails under certain transmission conditions or there may be an unnecessarily great dependence of transmission quality on transmission conditions.

It would thus be desirable to create a data transmission system which can always guarantee optimum transmission quality, regardless of whether data transmission conditions are variable or constant.

SUMMARY

In accordance with an example embodiment [Advantages] of [the Invention

The data transmission device according to] the present invention [having the features of Claim 1 and the corresponding data transmission method according to Claim 11 have the advantage in comparison with the related art that], a data transmission device is provided in which it is possible to accommodate different transmission properties [in this way].

In other words, it is possible to improve the data transmission under variable transmission conditions or to have data transmission quality be largely independent of transmission conditions. Assuming uniform transmission conditions, the resulting transmission quality will be either the same or better.

[The idea on which the present invention is based is to provide in addition] In accordance with the example embodiment, a determination device may be provided for determining the transmission properties of the data transmission channel(s) for multiple data transmission technologies and/or multiple data transmission parameters of one or more data transmission technologies and to provide a selector device for selecting a certain data transmission technology having certain data transmission parameters according to the result of the determination.

[The subordinate claims characterize advantageous refinements of and improvements on the data transmission device characterized in Claim 1 and/or the data transmission method characterized in Claim 11.

According to ]According to one example embodiment, a [preferred refinement of the present invention, the] selector device [is] may be provided in the transmitting device.

According to another [preferred refinement] example embodiment, the selector device [is] may be provided in the receiving device.

According to another [preferred refinement] example embodiment, the data transmission channel is a wireless channel.

According to another [preferred refinement] example embodiment, the determination device is designed to determine the rate of change of the data transmission channel.

According to another [preferred refinement] example embodiment, the selector device makes the selection in such a way that interference in the receiving device is eliminated when the rate of change of the data transmission channel exceeds a predetermined value, and interference in the transmitting device is eliminated when the rate of change of the data transmission channel drops below a predetermined value.

According to another [preferred refinement] example embodiment, the determination device is designed to determine the maximum delay of the data transmission channel.

According to another [preferred refinement] example embodiment, the selector device makes the selection in such a way that it selects a transmission technology having a certain burst structure as a function of the maximum delay determined for the data transmission channel.

According to another [preferred refinement] example embodiment, the selector device makes the selection in such a way that it selects a transmission technology having a certain reference signal as a function of the maximum delay determined for the data transmission channel and/or the rate of change determined.

According to another [preferred refinement] example embodiment, the data transmission device is a mobile wireless device, [preferably] for example, a mobile telephone.

[Drawings ]BRIEF DESCRIPTION OF THE DRAWINGS

[Embodiments of the present invention are illustrated in the drawings and are explained in greater detail in the following description.

They show:

Figure 1 -]Figure 1 shows a schematic diagram of a data transmission device [as] according to a first example embodiment of the present invention[;].

Figure 2 [-]shows a schematic diagram of a data transmission device [as] according to a second example embodiment of the present invention[;].

Figure 3 [-]shows a schematic diagram of a data transmission device [as] according to a third example embodiment of the

present invention[;].

Figure 4 [-]shows burst structures for estimating short and long channels[, and].

Figure 5 [-]shows burst structures for estimating slowly and rapidly variable channels.

[Description of Embodiments] DETAILED DESCRIPTION

In the figures, the same reference numbers denote the same components or those having the same function.

Figure 1 shows a schematic diagram of a data transmission device [as] according to a first embodiment of the present invention.

Figure 1 shows a transmitter 10, a receiver 20, a determination device 101 for determining the transmission properties of the transmission channel, a selector device 102 for selecting a certain data transmission technology having certain data transmission parameters as well as data messages D1 and D2.

[According to] As shown in the diagram [in] of Figure 1, transmitter 10 first sends an inquiry to receiver 20, requesting it to respond with various transmission technologies and parameters. Receiver 20 then sends data message D1 to transmitter 10, indicating which technologies and respective parameters are supported.

Determination device 101 then determines the transmission properties of the data transmission channel(s), and selector device 102 selects a certain data transmission technology having certain data transmission parameters according to the

result of the determination.

Transmitter 10 notifies receiver 20 of the technology selected and the respective parameters in data message D2.

Figure 2 shows a schematic diagram of a data transmission device as a second example embodiment of the present invention.

In addition to the determination device already introduced, Figure 2 also shows a determination device 201 for determining the transmission properties of the data transmission channel, a selector device 202 for selecting a certain data transmission technology having certain data transmission parameters as well as data messages D1' and D2'.

[According to] As shown in the diagram in Figure 2, receiver 20 first sends an inquiry to transmitter 10, requesting it to respond with various transmission technologies and parameters. Transmitter 10 then sends data message D2' to receiver 20, indicating which technologies and respective parameters are supported.

Determination device 201 then determines the transmission properties of the data transmission channel(s), and selector device 202 selects a certain data transmission technology having certain data transmission parameters according to the result of the determination.

Receiver 20 notifies transmitter 10 of the technology selected and the respective parameters in data message D1'.

Figure 3 shows a schematic diagram of a data transmission device [as] according to a third example embodiment of the

present invention.

The data transmission device [as an embodiment of the present invention according to] shown in Figure 3 is a cellular wireless transmission system in which there is a transmission from a base station BS to multiple mobile stations MS in the forward link and transmission from multiple mobile stations MS to base station BS in the reverse link. Data streams of various users (mobile stations MS) are separated by code division multiple access (CDMA), for example.

In the TDD wireless transmission system shown here, the forward and reverse links are in the same frequency band. The forward and reverse links are separated in time by alternating transmission of transmission bursts in the forward and reverse links.

Interference in the forward link is eliminated optionally either in the transmitter or in the receiver, e.g., by eliminating interference in the transmitter through joint preliminary equalization or by eliminating interference in the receiver through joint detection [according to] as described in the article by Klein et al. [(see] (discused above).

An example of selecting the technology for eliminating interference in the forward link would be to determine the rate of change of the wireless channel by comparing successive channel estimates in the base station and to eliminate interference through joint preliminary equalization in the transmitter if the rate of change is below a certain threshold, and to eliminate interference through joint detection in the receiver if the rate of change is above the threshold.

Figure 3 shows transmitted data SD, received data ED, duplexers 30 and 30', a modulator M1 without preliminary equalization, a modulator M2 having preliminary equalization, a modulator M, detectors 40, 40' and 40", a channel estimator 50 and 50', a determination device 60 and a decision-making device or selector device 70. Switches S and S' can be switched by decision-making device 70.

Base station BS has a transmission part having modulators M2 and M1 with and without preliminary equalization, respectively, and a reception part having detector 40 and channel estimator 50 as well as a decision-making part for making a decision between preliminary equalization and joint detection, composed of determination device 60 and decision-making device 70. Selector switch S is used to select modulator M1 or M2. Selector switch S is controlled by decision-making device 70.

Mobile station MS has a transmission part having modulator M and a reception part having channel estimator 50', as well as detector 40' for joint detection and detector 40" for simple detection.

Decision-making device 70 in base station BS selects either no preliminary equalization in base station BS and joint detection in mobile station MS, or preliminary equalization in base station BS and simple detection in mobile station MS, depending on the result obtained by channel estimator 50 and determination device 60. The decision made by decision-making device 70 of base station BS is relayed to mobile station MS over the wireless interface.

Figure 4 shows burst structures for estimating short and long channels.

Another example of a cellular wireless transmission system as an embodiment of the data transmission device according to the present invention has block-wise data transmission in a data burst structure as illustrated in Figure 4, where DB1 denotes a first data block, DB2 is a second data block, and MA is a midamble connected between them, with time t running from left to right.

The reverse link is optionally one of two possible burst structures, namely a burst structure having long data blocks and a short midamble, and a burst structure having short data blocks and a long midamble. The choice of data burst structure is made on the basis of a determination of the maximum channel delay by the mobile station in the forward link.

The choice of burst structure for the reverse link is made according to the maximum delay determined, namely a long midamble MA with long delays and a short midamble with short delays.

The type of burst that has been transmitted is determined in the receiver on the basis of the signal received. This embodiment can be used in particular in UMTS TDD mode.

Figure 5 shows burst structures for estimating slowly and rapidly variable channels.

In this embodiment in the form of a cellular wireless transmission system, there is block-wise data transmission in a data burst structure. Reference signal R or R1 or R2 and data block DB or DB1 or DB2 are sent in chronological order. One of two possible burst structures is optionally used, namely a long reference signal R and a long data block DB or multiple short reference signals R1, R2 which are separated

from one another by reduced data blocks DB1, DB2.

The burst structure is selected by determining the rate of change in the wireless channel with the help of the reference signal by a comparison of successive channel estimates in base station BS or in mobile station MS.

The burst having a long reference signal R is selected if the rate of change of the channel is below a certain threshold, and the burst having multiple short reference signals R1, R2 is selected if the rate of change is above the threshold.

The type of burst that has been transmitted is determined in the receiver on the basis of the received signal. This embodiment can also be used for the UMTS standard.

Although the present invention is described above on the basis of [preferred] example embodiments, it is not limited to these embodiments, but instead can be modified in various ways.

Another example embodiment [might be] includes a wireless transmission system which supports various standards such as transmission according to the GSM standard and transmission according to the USTM standard.

A determination of the rate of change of the wireless channel and the maximum channel delay could be provided here. The choice of the transmission technology and the respective transmission parameters could be made by optimizing the data transmission quality at the measured rate of change and the measured delays.

Contrary to the description [in] of the above example embodiments, the transmitter or receiver can also notify its

remote station, without being explicitly required to do so, regarding which transmission technologies and parameters it supports, e.g., directly after establishing the connection.

## [Abstract] ABSTRACT

A data transmission device is [created according to the present invention] described which may use multiple data transmission technologies and/or multiple data transmission parameters of one or more data transmission technologies, having at least one transmitting device and one receiving device which can communicate with one another over at least one data transmission channel. A determination device for determining the transmission properties of the data transmission channel(s) for multiple data transmission technologies and/or multiple data transmission parameters of one or more data transmission technologies, and a selector device for selecting a certain data transmission technology having certain data transmission parameters according to the result of the determination, are additionally provided so as to be able to accommodate different transmission properties. [(Figure 1)]

# DATA TRANSMISSION DEVICE AND METHOD

## Background Information

The present invention relates to a data transmission device which may use multiple data transmission technologies and/or multiple data transmission parameters of one or more data transmission technologies, having at least one transmitting device and one receiving device which can communicate with one another over at least one data transmission channel, as well as a corresponding data transmission method.

Although the present invention can be used with all desired data transmission technologies, it is explained here together with the problems on which it is based from the standpoint of mobile wireless technology.

There are various technologies in the related art for multichannel wireless transmission, in particular TDMA (time division multiple access), e.g., GSM (global system for mobile telecommunications) or UMTS (universal mobile telecommunication system), FDMA (frequency division multiple access), e.g., DECT (digital enhanced telecommunication), GSM (global system for mobile telecommunications), DAB (digital audio broadcasting) and CDMA (code division multiple access) (IS95, UMTS).

Problematic interference which can occur with these different technologies is usually handled in different ways, if at all. In particular, known methods include elimination of intersymbol interference (ISI), elimination of multiple access interference (MAI), elimination of interference in the

receiver, e.g., by equalizers or multiuser methods or joint detection methods, as well as elimination in the sender by pre-rake or joint preliminary equalization. See, for example, K. D. Kammeyer, "Nachrichtenübertragung [Transmission of Communications]," 2nd edition, *Information Technology Series*, Teubner, Stuttgart, 1996, and A. Klein, G. K. Kaleh and P. W. Baier, "Zero Forcing and Minimum Mean-Square-Error Equalization for Multiuser Detection in Code-Division Multiple-Access Channels," *IEEE Trans. Vehic. Tech.*, vol. 45 (1996), 276-287 and R. Esmailzadeh and M. Nakagawa, "Pre-Rake Diversity Combination for Direct Sequence Spread Spectrum Mobile Communications Systems," *IEICE Trans. Comm.*, vol. E76-B (1993), 1008-1015.

In addition, different parameters are generally used under different transmission conditions, e.g., in the UMTS TDD mode, where different types of bursts are used, depending on the maximum channel delay. In this regard, see the UMTS-L1 expert group: "UTRA Physical Layer Description, TDD parts, V 0.2.0."

One disadvantage of the known approaches has been found to be the fact that a transmission technology having a given set of parameters is more advantageous than another transmission technology only under certain transmission conditions or with certain transmission properties of the data transmission channel.

Therefore, it may occur that an unnecessarily low transmission quality prevails under certain transmission conditions or there may be an unnecessarily great dependence of transmission quality on transmission conditions.

It would thus be desirable to create a data transmission system which can always guarantee optimum transmission quality, regardless of whether data transmission conditions

are variable or constant.

Advantages of the Invention

The data transmission device according to the present invention having the features of Claim 1 and the corresponding data transmission method according to Claim 11 have the advantage in comparison with the related art that it is possible to accommodate different transmission properties in this way.

In other words, it is possible to improve the data transmission under variable transmission conditions or to have data transmission quality be largely independent of transmission conditions. Assuming uniform transmission conditions, the resulting transmission quality will be either the same or better.

The idea on which the present invention is based is to provide in addition a determination device for determining the transmission properties of the data transmission channel(s) for multiple data transmission technologies and/or multiple data transmission parameters of one or more data transmission technologies and to provide a selector device for selecting a certain data transmission technology having certain data transmission parameters according to the result of the determination.

The subordinate claims characterize advantageous refinements of and improvements on the data transmission device characterized in Claim 1 and/or the data transmission method characterized in Claim 11.

According to a preferred refinement of the present invention, the selector device is provided in the transmitting device.

According to another preferred refinement, the selector device is provided in the receiving device.

According to another preferred refinement, the data transmission channel is a wireless channel.

According to another preferred refinement, the determination device is designed to determine the rate of change of the data transmission channel.

According to another preferred refinement, the selector device makes the selection in such a way that interference in the receiving device is eliminated when the rate of change of the data transmission channel exceeds a predetermined value, and interference in the transmitting device is eliminated when the rate of change of the data transmission channel drops below a predetermined value.

According to another preferred refinement, the determination device is designed to determine the maximum delay of the data transmission channel.

According to another preferred refinement, the selector device makes the selection in such a way that it selects a transmission technology having a certain burst structure as a function of the maximum delay determined for the data transmission channel.

According to another preferred refinement, the selector device makes the selection in such a way that it selects a transmission technology having a certain reference signal as a function of the maximum delay determined for the data transmission channel and/or the rate of change determined.

According to another preferred refinement, the data

transmission device is a mobile wireless device, preferably a mobile telephone.

Drawings

Embodiments of the present invention are illustrated in the drawings and are explained in greater detail in the following description.

They show:

Figure 1 - a schematic diagram of a data transmission device as a first embodiment of the present invention;

Figure 2 - a schematic diagram of a data transmission device as a second embodiment of the present invention;

Figure 3 - a schematic diagram of a data transmission device as a third embodiment of the present invention;

Figure 4 - burst structures for estimating short and long channels, and

Figure 5 - burst structures for estimating slowly and rapidly variable channels.

Description of Embodiments

In the figures, the same reference numbers denote the same components or those having the same function.

Figure 1 shows a schematic diagram of a data transmission device as a first embodiment of the present invention.

Figure 1 shows a transmitter 10, a receiver 20, a

determination device 101 for determining the transmission properties of the transmission channel, a selector device 102 for selecting a certain data transmission technology having certain data transmission parameters as well as data messages D1 and D2.

According to the diagram in Figure 1, transmitter 10 first sends an inquiry to receiver 20, requesting it to respond with various transmission technologies and parameters. Receiver 20 then sends data message D1 to transmitter 10, indicating which technologies and respective parameters are supported.

Determination device 101 then determines the transmission properties of the data transmission channel(s), and selector device 102 selects a certain data transmission technology having certain data transmission parameters according to the result of the determination.

Transmitter 10 notifies receiver 20 of the technology selected and the respective parameters in data message D2.

Figure 2 shows a schematic diagram of a data transmission device as a second embodiment of the present invention.

In addition to the determination device already introduced, Figure 2 also shows a determination device 201 for determining the transmission properties of the data transmission channel, a selector device 202 for selecting a certain data transmission technology having certain data transmission parameters as well as data messages D1' and D2'.

According to the diagram in Figure 2, receiver 20 first sends an inquiry to transmitter 10, requesting it to respond with various transmission technologies and parameters. Transmitter 10 then sends data message D2' to receiver 20, indicating

which technologies and respective parameters are supported.

Determination device 201 then determines the transmission properties of the data transmission channel(s), and selector device 202 selects a certain data transmission technology having certain data transmission parameters according to the result of the determination.

Receiver 20 notifies transmitter 10 of the technology selected and the respective parameters in data message D1'.

Figure 3 shows a schematic diagram of a data transmission device as a third embodiment of the present invention.

The data transmission device as an embodiment of the present invention according to Figure 3 is a cellular wireless transmission system in which there is a transmission from a base station BS to multiple mobile stations MS in the forward link and transmission from multiple mobile stations MS to base station BS in the reverse link. Data streams of various users (mobile stations MS) are separated by code division multiple access (CDMA), for example.

In the TDD wireless transmission system shown here, the forward and reverse links are in the same frequency band. The forward and reverse links are separated in time by alternating transmission of transmission bursts in the forward and reverse links.

Interference in the forward link is eliminated optionally either in the transmitter or in the receiver, e.g., by eliminating interference in the transmitter through joint preliminary equalization or by eliminating interference in the receiver through joint detection according to Klein et al. (see above).

An example of selecting the technology for eliminating interference in the forward link would be to determine the rate of change of the wireless channel by comparing successive channel estimates in the base station and to eliminate interference through joint preliminary equalization in the transmitter if the rate of change is below a certain threshold, and to eliminate interference through joint detection in the receiver if the rate of change is above the threshold.

Figure 3 shows transmitted data SD, received data ED, duplexers 30 and 30', a modulator M1 without preliminary equalization, a modulator M2 having preliminary equalization, a modulator M, detectors 40, 40' and 40", a channel estimator 50 and 50', a determination device 60 and a decision-making device or selector device 70. Switches S and S' can be switched by decision-making device 70.

Base station BS has a transmission part having modulators M2 and M1 with and without preliminary equalization, respectively, and a reception part having detector 40 and channel estimator 50 as well as a decision-making part for making a decision between preliminary equalization and joint detection, composed of determination device 60 and decision-making device 70. Selector switch S is used to select modulator M1 or M2. Selector switch S is controlled by decision-making device 70.

Mobile station MS has a transmission part having modulator M and a reception part having channel estimator 50', as well as detector 40' for joint detection and detector 40" for simple detection.

Decision-making device 70 in base station BS selects either no preliminary equalization in base station BS and joint

detection in mobile station MS, or preliminary equalization in base station BS and simple detection in mobile station MS, depending on the result obtained by channel estimator 50 and determination device 60. The decision made by decision-making device 70 of base station BS is relayed to mobile station MS over the wireless interface.

Figure 4 shows burst structures for estimating short and long channels.

Another example of a cellular wireless transmission system as an embodiment of the data transmission device according to the present invention has block-wise data transmission in a data burst structure as illustrated in Figure 4, where DB1 denotes a first data block, DB2 is a second data block, and MA is a midamble connected between them, with time t running from left to right.

The reverse link is optionally one of two possible burst structures, namely a burst structure having long data blocks and a short midamble, and a burst structure having short data blocks and a long midamble. The choice of data burst structure is made on the basis of a determination of the maximum channel delay by the mobile station in the forward link.

The choice of burst structure for the reverse link is made according to the maximum delay determined, namely a long midamble MA with long delays and a short midamble with short delays.

The type of burst that has been transmitted is determined in the receiver on the basis of the signal received. This embodiment can be used in particular in UMTS TDD mode.

Figure 5 shows burst structures for estimating slowly and

rapidly variable channels.

In this embodiment in the form of a cellular wireless transmission system, there is block-wise data transmission in a data burst structure. Reference signal R or R1 or R2 and data block DB or DB1 or DB2 are sent in chronological order. One of two possible burst structures is optionally used, namely a long reference signal R and a long data block DB or multiple short reference signals R1, R2 which are separated from one another by reduced data blocks DB1, DB2.

The burst structure is selected by determining the rate of change in the wireless channel with the help of the reference signal by a comparison of successive channel estimates in base station BS or in mobile station MS.

The burst having a long reference signal R is selected if the rate of change of the channel is below a certain threshold, and the burst having multiple short reference signals R1, R2 is selected if the rate of change is above the threshold.

The type of burst that has been transmitted is determined in the receiver on the basis of the received signal. This embodiment can also be used for the UMTS standard.

Although the present invention is described above on the basis of preferred embodiments, it is not limited to these embodiments, but instead can be modified in various ways.

Another embodiment might be a wireless transmission system which supports various standards such as transmission according to the GSM standard and transmission according to the USTM standard.

A determination of the rate of change of the wireless channel

and the maximum channel delay could be provided here. The choice of the transmission technology and the respective transmission parameters could be made by optimizing the data transmission quality at the measured rate of change and the measured delays.

Contrary to the description in the above embodiments, the transmitter or receiver can also notify its remote station, without being explicitly required to do so, regarding which transmission technologies and parameters it supports, e.g., directly after establishing the connection.

What is claimed is:

1. A data transmission device which may use multiple data transmission technologies and/or multiple data transmission parameters of one or more data transmission technologies, having at least one transmitting device and one receiving device which can communicate with one another over at least one data transmission channel, characterized by
a determination device for determining the transmission properties of the data transmission channel(s) for multiple data transmission technologies and/or multiple data transmission parameters of one or more data transmission technologies, and
a selector device for selecting a certain data transmission technology having certain data transmission parameters according to the result of the determination.

2. The data transmission device according to Claim 1, wherein the selector device is provided in the transmitting device.

3. The data transmission device according to Claim 1, wherein the selector device is provided in the receiving device.

4. The data transmission device according to one of the preceding claims,
wherein the data transmission channel is a wireless channel.

5. The data transmission device according to one of the preceding claims,
wherein the determination device is designed to determine the rate of change of the data transmission channel.

6. The data transmission device according to Claim 5,

wherein the selector device makes the selection in such a way that interferences in the receiving device are eliminated when the rate of change of the data transmission channel exceeds a predetermined value, and
interferences in the transmitting device are eliminated when the rate of change of the data transmission channel drops below a predetermined level.

7. The data transmission device according to one of the preceding claims,
wherein the determination device is designed to determine the maximum delay of the data transmission channel.

8. The data transmission device according to Claim 7,
wherein the selector device makes the selection in such a way that it selects a transmission technology having a certain burst structure as a function of the maximum delay determined for the data transmission channel.

9. The data transmission device according to Claim 5 or 7,
wherein the selector device makes the selection in such a way that it selects a transmission technology having a certain reference signal as a function of the maximum delay determined for the data transmission channel and/or the rate of change determined.

10. The data transmission device according to one of the preceding claims,
wherein it is a mobile wireless device, preferably a mobile telephone.

11. A data transmission method which may use multiple data transmission technologies and/or multiple data transmission parameters of one or more data transmission technologies for implementation on at least one transmitting device and one

receiving device which can communicate with one another over at least one data transmission channel,
characterized by the steps

determination of the transmission properties of the data transmission channel(s) for multiple data transmission technologies and/or multiple data transmission parameters of one or more data transmission technologies; and

selection of a certain data transmission technology having certain data transmission parameters according to the result of the determination.

Abstract

A data transmission device is created according to the present invention which may use multiple data transmission technologies and/or multiple data transmission parameters of one or more data transmission technologies, having at least one transmitting device and one receiving device which can communicate with one another over at least one data transmission channel. A determination device for determining the transmission properties of the data transmission channel(s) for multiple data transmission technologies and/or multiple data transmission parameters of one or more data transmission technologies, and a selector device for selecting a certain data transmission technology having certain data transmission parameters according to the result of the determination, are additionally provided so as to be able to accommodate different transmission properties.

(Figure 1)

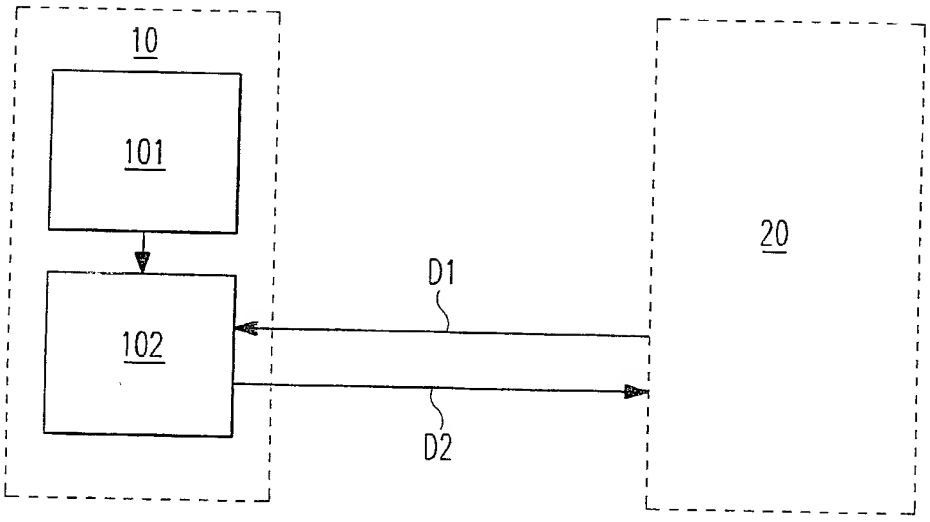


Fig. 1

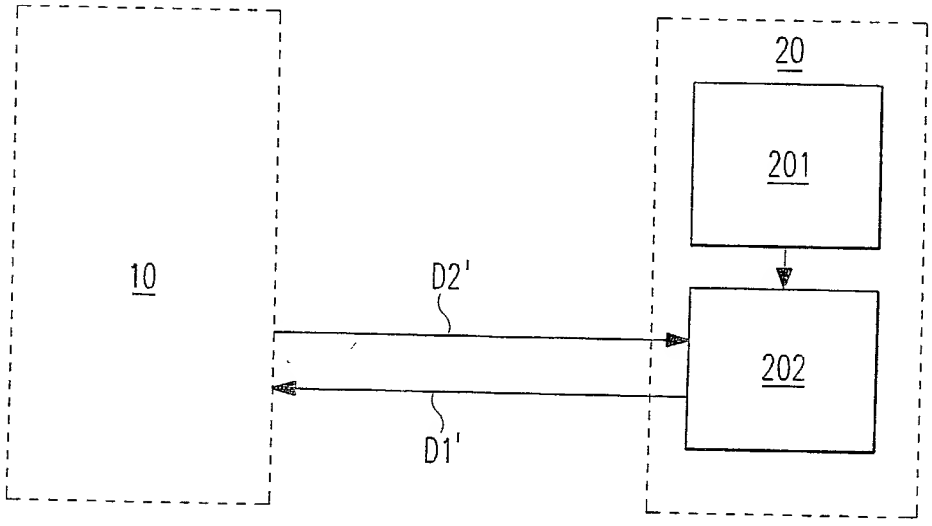


Fig. 2

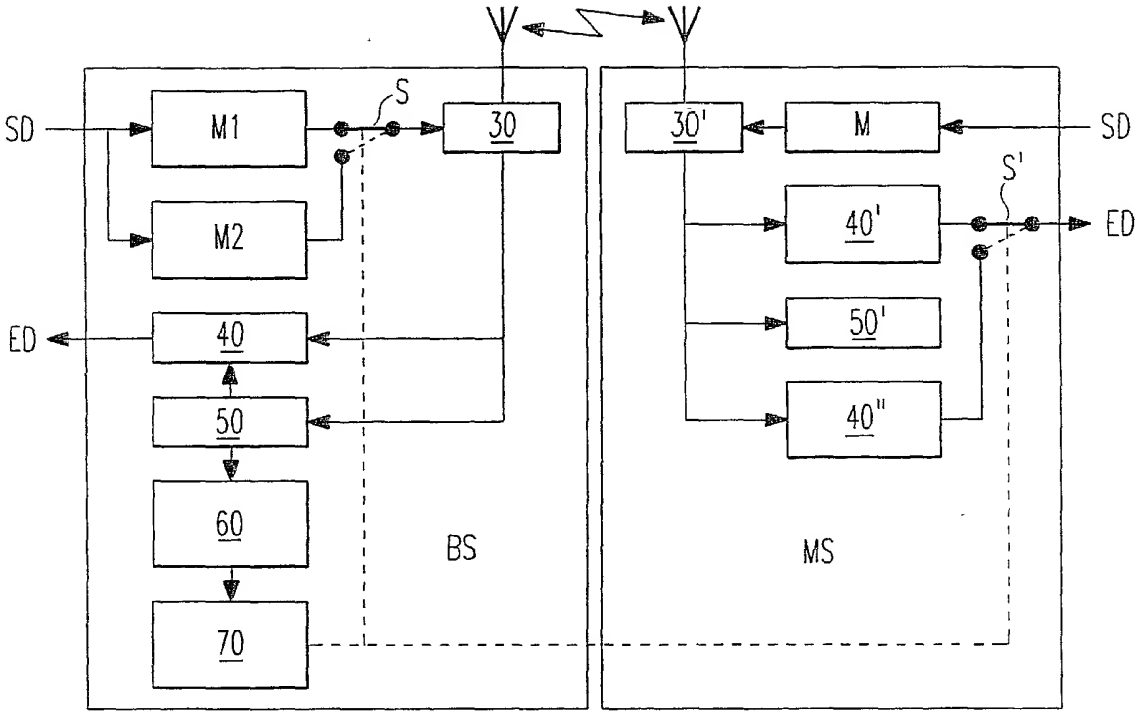


Fig. 3

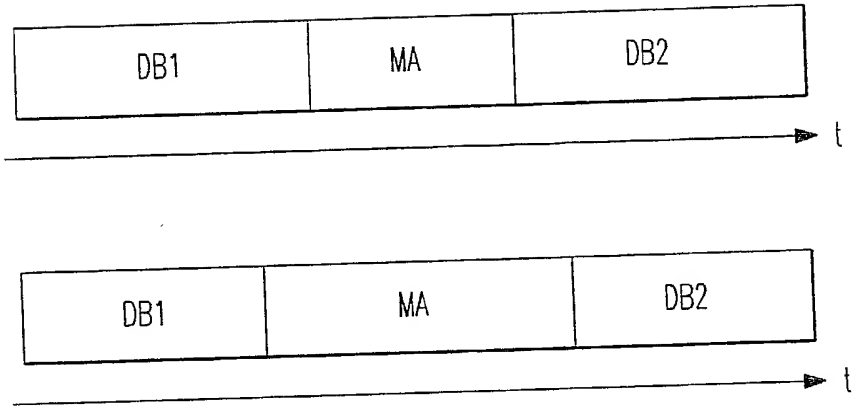


Fig. 4

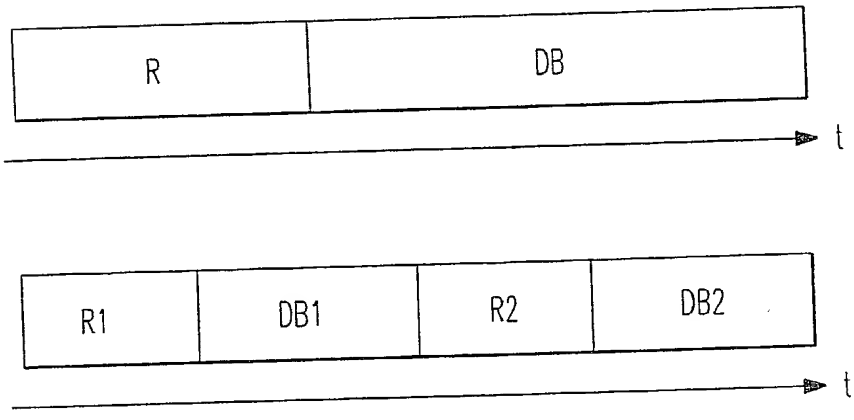


Fig. 5

# COMBINED DECLARATION AND POWER OF ATTORNEY FOR PATENT APPLICATION

As a below named inventor, I hereby declare that:

My residence, post office address and citizenship are as stated below adjacent to my name.

I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled **DATA TRANSMISSION DEVICE AND METHOD,** and the specification of which:

[ ] is attached hereto;

[X] was filed as PCT International Application Number PCT/DE00/00430, on the 15th day of February 2001 and entered the National Phase as U.S. Serial No. 09/936,115..

[X] an English translation of which is filed herewith.

I hereby state that I have reviewed and understand the contents of the above-identified specification, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose information which is material to the examination of this application in accordance with Title 37, Code of Federal Regulations, §1.56(a). I hereby claim foreign priority benefits under Title 35, United States Code § 119 of any foreign application(s) for patent or inventor's certificate or of any PCT international applications(s) designating at least one country other than the United States of America listed below and have also identified below any foreign application(s) for patent or inventor's certificate or any PCT international application(s) designating at least one country other than the United States of America filed by me on the same subject matter having a filing date before that of the application(s) of which priority is claimed:

**PRIOR FOREIGN/PCT APPLICATION(S)**
**AND ANY PRIORITY CLAIMS UNDER 35 U.S.C. § 119**

Country : Germany

Application No. : 199 09 921.9

Date of Filing: March 6, 1999

Priority Claimed
Under 35 U.S.C. § 119 : [X] Yes [ ] No

I hereby claim the benefit under Title 35, United States Code § 120 of any United States Application or PCT International Application designating the United States of America that is/are listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in that/those prior application(s) in the manner provided by the first paragraph of Title 35, United States Code § 112, I acknowledge the duty to disclose material information as defined in Title 37, Code of Federal Regulations § 1.56(a) which occurred between the filing date of the prior application(s) and the national or PCT international filing date of this application:

**PRIOR U.S. APPLICATIONS OR**
**PCT INTERNATIONAL APPLICATIONS**
**DESIGNATING THE U.S. FOR BENEFIT UNDER 35 U.S.C. § 120**

U.S. APPLICATIONS

Number :

Filing Date :

PCT APPLICATIONS
DESIGNATING THE U.S.

PCT Number :

PCT Filing Date :

I hereby appoint the following attorney(s) and/or agents to prosecute the above-identified application and transact all business in the Patent and Trademark Office connected therewith.

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I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment or both under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issuing thereon.

100

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Inventor's signature F. Kowalewski Date 7.11.2001

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